1. Introduction

Social media technologies have been touted to bring about unprecedented changes to how people produce and obtain information such as news. Owing to their open and interactive nature, people are able to actively create and share information with each other, rather than just being a passive information receiver. Indeed, they are deemed to be user-centric and able to facilitate communal activities, implying that users and their interactions are at the core of these technologies (van Dijck, 2013).

Being a typical form of social media technologies, Twitter has drawn substantial attention from both researchers and practitioners in recent years (e.g., Cha et al., 2010; Bakshy, et al., 2011; Hermida, 2010, 2014; Kwak, et al. 2010; Mocanu, et al. 2013). Twitter allows users to send short messages of less than 140 characters, or "micro-blogs", in an instantaneous manner to other users. It has described itself as "a real-time information network that connects you to the latest information about what you find interesting". Prior research notes that the technology enables users to "obtain immediate access to information held by all or at least most, and in which each person can instantly add to that knowledge" (Sunstein, 2006). Noting this characteristic, the extant research has argued that the technology (and social media alike) may enable new relational structures that disrupt the existing authoritative structures and established ways of information flow, one pertinent area being news dissemination (Hermida, et al. 2012; Boyd and Marwick, 2011).

Twitter is used extensively by individuals to read and share news with each other. For instance, it has emerged as a major platform to help report, organize and disseminate news information during major events such as the US presidential elections in 2008 (Lenhart and Fox, 2009) and the Euromaidan revolution in 2013 (Ronzhyn, 2014). Indeed, Smith and Rainie (2010) found that news sharing on Twitter is very common, with 55 per cent of users posting links to news stories. A study by An et al. (2011) also found that news messages was forwarded 15.5 times on average, thereby substantially increasing the reach of their audience. Yet, at the same time, Twitter fosters the dissemination of short fragments of information from a diversity of news sources, both official and unofficial ones (Goodrum et al., 2010; Hermida, 2010). This is deemed to have challenged the conventional ways of news dissemination that are mainly controlled by official, authoritative news sources (e.g., CNN, New York Times), and undermined the gatekeeping function of journalists in determining the what and when of news content dissemination (Hermida, 2010).

Along the same vein, it has been argued that given the interactive nature of social media such as Twitter, conventional mass media may lose out in competing for news audience (Dimmick et al. 2011; Lee and Ma, 2012). This has led to the view that "news media

business managers and journalists face increasing uncertainty of what the future holds, and the institutions of journalism find themselves in crisis." (Adcock 2016, p.2) In response, conventional mass media have attempted to involve by establishing their presence on Twitter and disseminating news on the platform themselves (Lasorsa et al. 2011). On the flip side, it is worth noting that the open nature of Twitter makes it prone to disseminating rumors or fake news, and ordinary users play a big part in this dissemination (Vosoughi et al. 2018). This may potentially discount the role and importance of news dissemination on Twitter, especially when non-mass media users are concerned.

In view of the mixed perspectives above, this study aims to conduct a comprehensive investigation on news dissemination on Twitter, in particular with respect to how different participants, including mass media and non-mass media/ordinary users, involve in the dissemination as well as their influence generated. Our formal research questions are: What types of participants are more active in disseminating news on Twitter? What are the relative influences they generate in the news dissemination? We seek answers to these research questions via two means: 1) examining both tweet and retweeting[1] behaviors of users, which respectively correspond to levels of their involvement and their influence generated (Cha et al. 2010); 2) based on a combination of machine analysis and human coding, identifying a comprehensive list of participants on Twitter including mass media (further differentiated into major news agencies, radio and TV stations, news aggregators, other news agencies), journalists (further differentiated into those affiliated to media and the independent journalists), bloggers (further differentiated into blogging associations and independent bloggers), organizations (further differentiated into commercial and non-commercial), and celebrities. These considerations allow us to obtain a clearer understanding on the involvement and influence of the different participants in news dissemination on Twitter.

In the followings, we first present a review of the relevant literature on Twitter and news dissemination.

2. Literature Review

A number of prior studies have investigated how Twitter is used for news dissemination. An early seminal study that notes such a usage of Twitter was Kwak et al. (2010); they showed that Twitter serves mainly as a news medium rather than a social network given its characteristics such as a low reciprocity among the participants. This was echoed by

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[1] Retweet refers to the reposting of a tweet content while referencing either the source of the content or the last person who shared it (Boyd et al., 2010).

several other studies. For instance, Goodrum et al. (2010) found that people prefer using social media such as Twitter to obtain news information due to its currency. In line with this, Hu et al. (2012) observed that Twitter broke the news on Osama Bin Laden's death before the mainstream media. In addition, Hermida (2010) noted that Twitter enables ambient journalism, defined as an awareness system that offers citizens with diverse means to collect, communicate, share and display a variety of news information. He and his co-authors (Hermida et al., 2012) further employed survey to show that users valued social media as a news source because it exposed and helped them to keep up with a wide range of news events.

In view of this trend, conventional mass media have tried to establish their presence and disseminate news on Twitter (Armstrong and Gao 2010; Meyer and Tang 2015). For instance, it has been used by journalists to recommend news stories (Phelan et al. 2009), and by newsroom to feed news headlines to their Twitter streams (Palser 2009). Research has also investigated strategies that can be used by conventional mass media and journalists to attract greater user attention to their news, such as enriching news tweets with hashtags and media contents, and engaging in personal interactions with other tweeters (Orellana-Rodriguez et al. 2017). In addition, journalists take advantage of Twitter as news sources, e.g., by observing breaking news information posted by users such as the first accounts, images or video of a news event (Hermida 2010). However, it should also be noted that some journalists are rather cautious and reluctant to use information from Twitter in their news coverage due to the invalidity of the information, and if they do, use it in an opportunistic way (Broersma and Graham 2013; Bruno 2011). Regardless, it can be seen that there is likely a mixture of participants on Twitter with regard to news dissemination.

Indeed, Lotan et al. (2011) considered a wider range of participant types including bloggers and activists, and investigates how they participated in the disseminations of news during the Tunisian and Egyptian Revolutions. They concluded that such news on Twitter is being co-constructed by bloggers and activists alongside journalists. Hu et al. (2012) noted the involvement of three groups of influential participants or opinion leaders, i.e., mass media, individuals affiliated with media, and celebrities. Focusing on news related to the Arab Spring, Hermida et al. (2014) studied how a key information broker during the event, Andy Carvin, selected sources of news to cite in his tweets. They found that non-elite sources (e.g., bloggers, activists, non-media organizations) had a greater representation than elite sources in the content that Andy Carvin cited. However, Poell and Borra (2012) found that the use of social media including Twitter appears less of a success from the perspective of providing a more balanced participation and coverage of activist news reporting such as the G20 protests in Toronto. Hudoshnyk (2015), focusing on the Ukraine's Euromaidan news, also cautioned that social media including Twitter might be given too much credence for social uprisings such as the event they investigated.

Furthermore, research has discussed the pros and cons of Twitter in news dissemination. On one hand, the open and interactive nature of Twitter makes it conducive for anyone to participate in news dissemination. Users are able to easily share their first-hand news accounts and witnesses on Twitter, and previous research shows that people have high willingness to provide relevant and updated information to others (Abdullah et al. 2017). Such information shared by fellow users may be deemed more trustworthy than those provided by mass media, which may be biased and deemed farther away from ordinary users' everyday life (Skoler 2009). On the other hand, the very same nature of Twitter also makes it prone to issues such as the dissemination of rumors or fake news (e.g., Tanaka et al. 2012; Gupta et al. 2013; Vosoughi et al. 2018). For instance, a recent study by Vosoughi et al. (2018) shows that fake news spread more than truth on Twitter. Taken together, with the variety of participants on Twitter and the different nature of news information they provide (editorial vs. user-generated), it remains unclear who would involve more in news dissemination on Twitter, and who are more influential in the process.

With reference to the above discussions, our study aims to contribute to the extant literature in three ways. First, in contrast to previous studies that employed a limited set of sampled data, our study employs more extensive data comprising 95,986 tweets extracted during the Ukraine's conflict in Kyiv from November 21, 2013 until Crimean Tartars supporting the new Kiev administration clashed with pro-Russia protesters in the region on February 26, 2014. Second, we comprehensively coded the categories of participants, including mass media, journalists, bloggers, organizations, and celebrities (refer to the Research Method section for details). Third, while previous research mainly relied on human coding to perform the categorizations, we employed a combination of machine analysis and human coding to achieve the purpose in view of the large dataset. Collectively, these measures allow us to more accurately and comprehensively examine how the various participants were involved in the Ukraine's conflict tweeting activities, and which among them were more influential than others in the related news dissemination.

3 Research Method

We embarked on a series of efforts to categorize the different types of participants on Twitter, first via machine analysis and then through human coding. We extracted tweets posted during the Ukraine's conflict in Kyiv from November 21, 2013 until Crimean Tartars supporting the new Kiev administration clashed with pro-Russia protesters in the region on February 26, 2014. Table 1 below depicts the key events that occurred during the whole episode.

Key event	Date
Protests gathered pace, as 100,000 people attended a demonstration in Kiev.	Late November 2013
Protesters occupied Kiev city hall and Independence Square in dramatic style. Some 800,000 people rallied in Kiev.	Early December 2013
Vladimir Putin threw President Yanukovych an economic lifeline, agreeing to buy $15bn of Ukrainian debt and reduce the price of Russian gas supplies by about a third	17 December
Parliament passed restrictive anti-protest laws as clashes turn deadly. Protesters began storming regional government offices in Western Ukraine.	16-23 January
Prime Minister Mykola Azarov resigned and parliament annulled the anti-protest law. Parliament passed amnesty bill but opposition rejected conditions.	28-29 January
All 234 protesters arrested since December were released. Kiev city hall, occupied since 1 December, was abandoned by demonstrators, along with other public buildings in regions.	14-16 February
Clashes erupted, with reasons unclear: 18 dead.	18 February
Kiev saw its worst day of violence for almost 70 years. At least 88 people were killed in 48 hours. Video showed uniformed snipers firing at protesters holding makeshift shields.	20 February
President Yanukovych signed compromise deal with opposition leaders.	21 February
• President Yanukovych disappeared • Protesters took control of presidential administration buildings • Parliament voted to remove president from power with elections set for 25 May • Mr Yanukovych appeared on TV to denounce 'coup' • His arch-rival Yulia Tymoshenko was freed from jail	22 February
Ukraine's parliament assigned presidential powers to its new speaker, Oleksandr Turchinov, an ally of Tymoshenko. Pro-Russian protesters rallied in Crimea against the new Kiev administration	23 February
Ukraine's interim government drew up a warrant for Yanukovich's arrest.	24 February
Pro-Russian Aleksey Chaly was appointed Sevastopol's de facto mayor as rallies in Crimea continue.	25 February
Crimean Tartars supporting the new Kiev administration clashed with pro-Russia protesters in the region.	26 February

1   *Table 1 Key Events during the Ukraine Conflict*

2   The data was extracted by crawling Twitter for tweets that contain the word "Ukraine"
3   or "Russia" at every 15-minute interval, covering most of the related tweets posted
4   during the time period. The tweets irrelevant to the Ukraine's conflict, such as weather

in Ukraine tweets, were removed. Altogether 95,986 tweets were obtained in total. In analyzing the data, we considered two types of tweets: event-based and people-related tweets. For event-related tweets, we further extracted the tweets based on the following two sets of keywords: 1) "protest" and "square", and 2) "Russia" and "troops". These keywords were selected because they were related to two key events that occurred during the conflict that attracted most attention, and resulted in respectively 7,429 and 12,333 tweets extracted. For people-related tweets, we further extracted the tweets based on the following two sets of keywords: 1) "Obama", and 2) "Putin", as they are the key political figures who made decisions that affected how the conflict evolved during the whole episode. This resulted in respectively 27,973 and 48,251 tweets extracted. These tweets were subsequently used as the inputs for our data analyses.

As mentioned, we comprehensively coded the categories of participants in the dissemination of the focal news event, including mass media (further differentiated into major news agencies, radio and TV stations, news aggregators, other news agencies), journalists (further differentiated into those affiliated to media and those independent journalists), bloggers (further differentiated into blogging associations and independent bloggers), and organizations (further differentiated into commercial and non-commercial), and celebrities. Table 2 below presents descriptions of the different categories of participants.

Type	Description	Examples
Mass media		
Major news agencies	Mainstream news producers that are directly linked to corporate conglomerates	@CNN, @BBCNews
Radio and TV stations	Mainstream news producers that are linked to radio and TV stations	@PressTV (a TV broadcaster)
Other news agencies	Various non mainstream news producers, such as non-commercial or regional news agencies	@ria_novosti, @IndyWorld
News aggregators	Aggregate news from other news producers, but do not produce news themselves	@MSN
Journalists		
Affiliated	Individual journalists who are affiliated to a news agency	@patrickjackson (affiliated to BBC)
Independent	Individual journalists who produce first-hand news materials, e.g., interviews, photos, etc., but are not affiliated to a news agency	@AHernandezDj (journalist and DJ)
Bloggers		
Blogging associations	Blogging platforms that host blogs on news from different sources	@mashable
Independent bloggers	Independent bloggers who are not affiliated to any news media and do not produce news by themselves; they highlight or forward news information	@ArminaLaManna (self-described as storyteller, director, and writer)

	from other sources	
Organizations		
Commercial	Commercial organizations	@JECComposites (an organization dedicated to promote composite materials internationally)
Non-commercial	Non-profit, grassroots organizations	@100prayingwomen
Celebrities	Individuals who are famous for reasons unrelated to politics or activism.	@KirkWhalum (Grammy-winning jazz saxophonist / recording artist)

Table 1 Descriptions of the Participant Categories

To implement the categorizations based on machine analysis, we first extracted a set of Boolean features based on the "user_screen_name" and "user_description". These features were derived by observations in the dataset and the known list of some specific media names (refer to Table A1 in the Appendix). Based on the values of the features, we employed heuristic rules to categorize the participants based on the values of the features (refer to Table A2 in the Appendix). We conducted the clustering for several rounds to increase accuracy. For example, categories 'Journalists Affiliated to News Agency' and 'Independent Journalists' were originally clustered into one 'Journalists' category. Upon closer inspection of randomly selected users from the 'Journalists' category, we added two features, i.e., 'affiliated' and 'independent' to differentiate between the 'Journalists Affiliated to News Agency' and 'Independent Journalists'. We also manually coded the participants in the 'Others' category who were not identified by the feature rules, but who owns a website or a webpage either as non-commercial participants, commercial organizations, or celebrities.

4 Analysis Results

With all the eligible[2] tweets coded, we analyzed the spread of involvement and influence of the different participants. We present the analysis results first regarding the levels of involvement followed by the levels of influence of the different participants.

4.1 Analysis of levels of involvement

We first present the results of analyzing the levels of involvement of the different participants. Figure 1 and Figure 2 present the results respectively for the analyses based on the event-related keyword sets of 1) "protest" and "square"; and 2) "Russia" and "troops".

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[2] Some were removed because of an absence of URL to reliably categorize the participants.
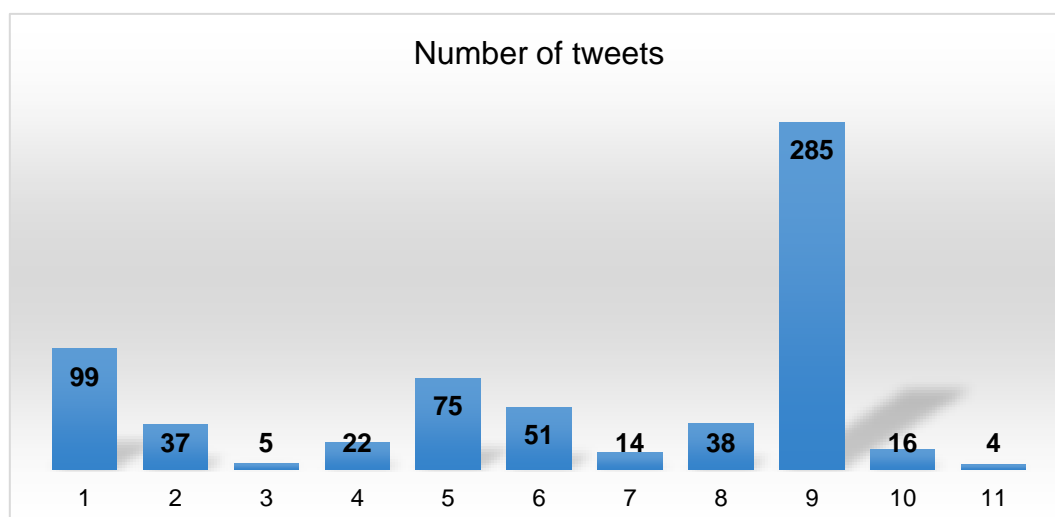
Number of tweets

1

Fig. 1 Levels of Involvement of the Different Participants for Tweets related to "Protest" and "Square"

Legends: 1- Major news agencies; 2- Radio and TV stations; 3- Other news agencies; 4-News aggregator; 5- Journalists (affiliated); 6- Journalists (independent); 7- Blogging associations; 8- Independent bloggers; 9- Non-commercial participants; 10- Commercial organizations; 11- Celebrities
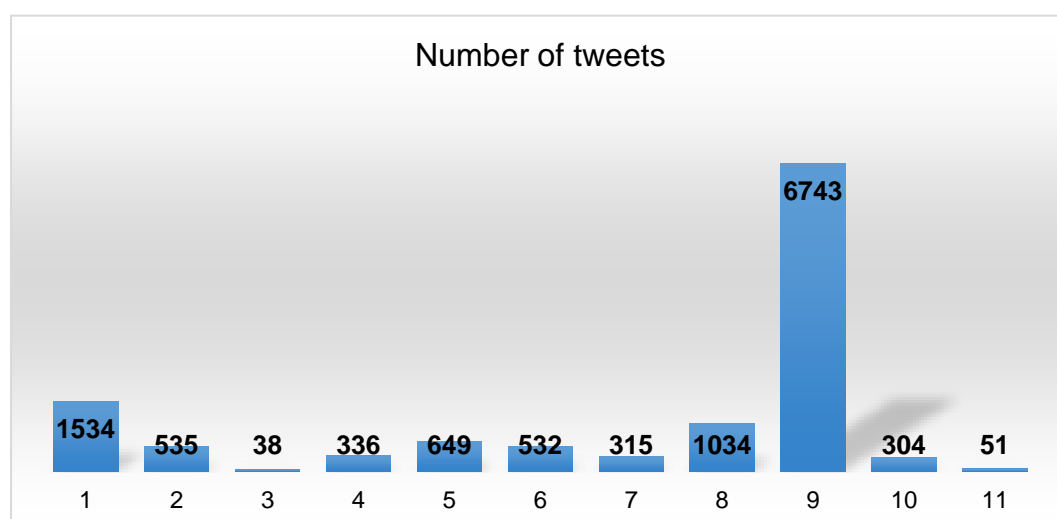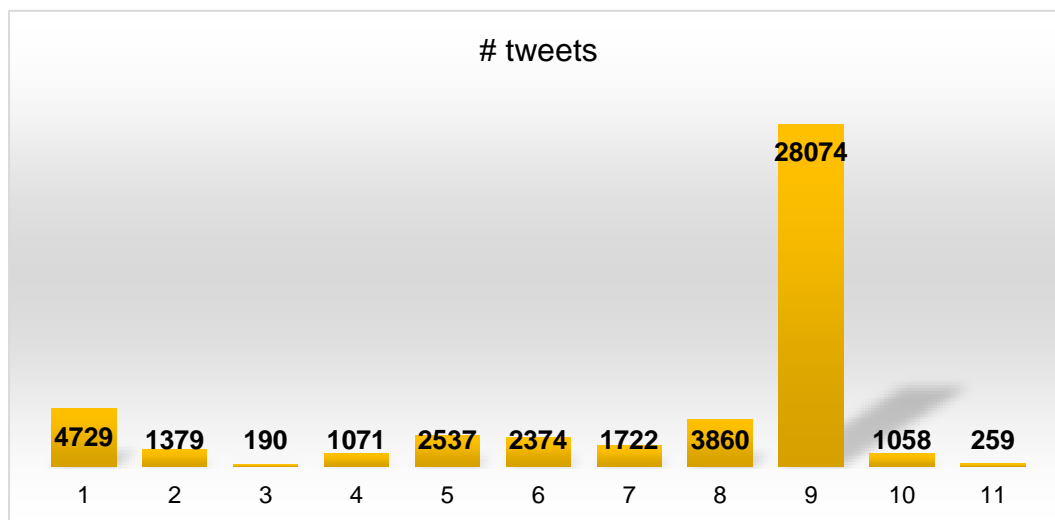

Number of tweets

Fig. 2 Levels of Involvement of the Different Participants for Tweets related to "Russia" and "Troops"

From Figure 1 and Figure 2, the levels of involvement of the different participants appear quite consistent. Specifically, non-commercial participants were notably the most active in posting tweets related to the two events. This seems consistent with the general view that grassroots and lay people dominate and take a central stage on the social media. It is also to note that major news agencies participated quite actively in positing the related tweets (second most active in both the events), although to a much lesser extent.

Next we analyze the levels of involvement of the different participants when tweets related to the key political figures ("Putin", "Obama") were concerned (Figure 3 and

1   Figure 4 below).

2

tweets

28074

4729 1379 190 1071 2537 2374 1722 3860   1058 259
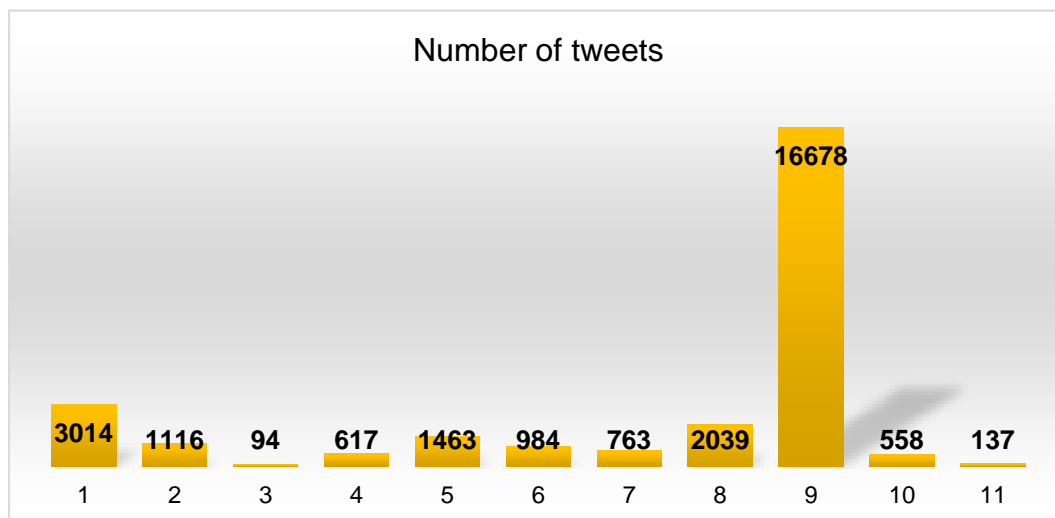 1   2   3   4   5   6   7   8   9   10   11

3
4   **Fig. 3** Levels of Involvement of the Different Participants in Tweets related to "Putin"

Legends: 1- Major news agencies; 2- Radio and TV stations; 3- Other news agencies; 4-News aggregator; 5- Journalists (affiliated); 6- Journalists (independent); 7- Blogging associations; 8- Independent bloggers; 9- Non-commercial participants; 10- Commercial organizations; 11- Celebrities

5

Number of tweets

16678

3014 1116 94 617 1463 984 763 2039   558 137
  1   2   3   4   5   6   7   8   9   10   11

6
7   **Fig. 4** Levels of Involvement of the Different Participants in Tweets related to "Obama"

8   From Figure 3 and Figure 4, the levels of involvement of the different participants are
9   highly consistent with those depicted in Figure 1 and Figure 2. That is, non-commercial
10   participants are the most active in generating tweets about the key political figures
11   "Putin" and "Obama". In addition, major news agencies remain the next most active,
12   although again to a much lesser extent.

13

14

1   **4.2 Analysis of levels of influence**
2
3   As with the analysis of the levels of involvement, we first present the results of
4   analyzing the levels of influence of the different participants for event-related tweets
5   (see Figure 5 and Figure 6). We employed average number of retweets to indicate the
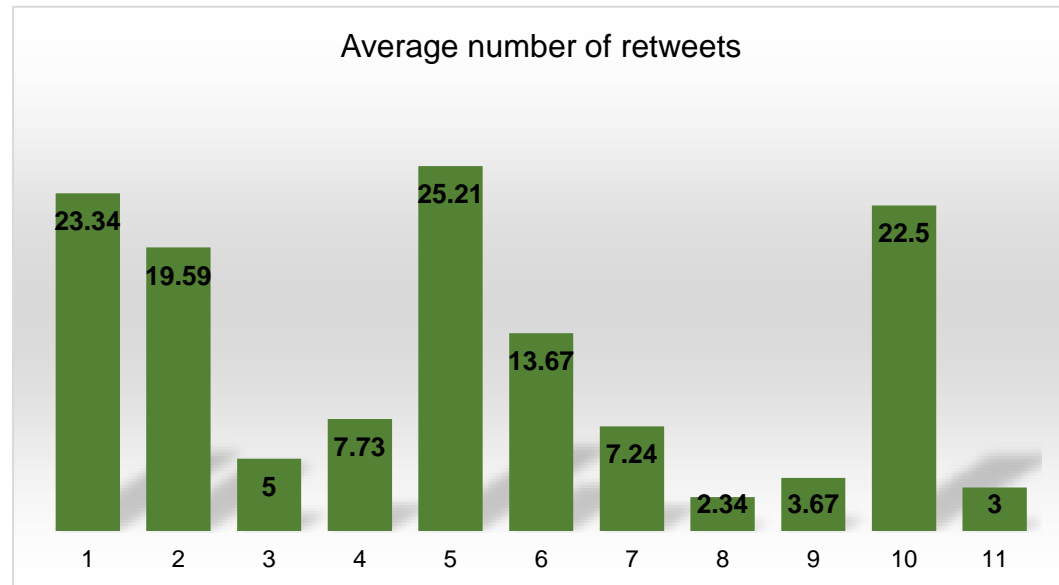6   levels of influence of the different participants.
7

8
9   **Fig. 5** Levels of Influence of the Different Participants for Tweets related to "Protest" and "Square"

Legends: 1- Major news agencies; 2- Radio and TV stations; 3- Other news agencies; 4-News aggregator; 5- Journalists (affiliated); 6- Journalists (independent); 7- Blogging associations; 8- Independent bloggers; 9- Non-commercial participants; 10- Commercial organizations; 11- Celebrities
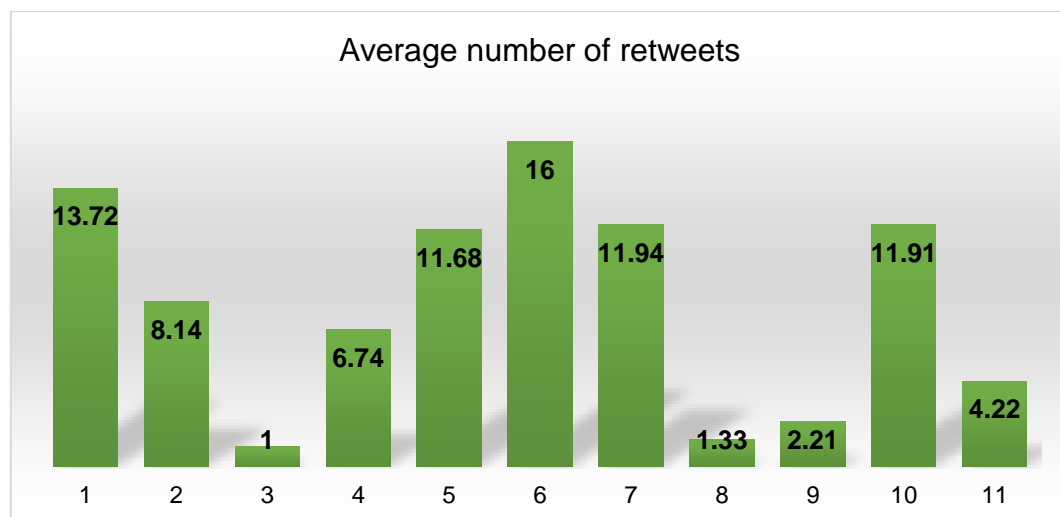
10

11
12   **Fig. 6** Levels of Influence of the Different Participants for Tweets related to "Russia" and "Troops"

13   From Figure 5 and Figure 6, a strikingly different pattern emerges when the number of

retweets garnered by the different participants was examined. Five types of participants consistently attracted the most retweets in both cases, i.e., major news agencies, radio and TV stations, affiliated journalists, independent journalists, and commercial organizations. In the tweets related to the keyword set "Russia" and "troops", the number of retweets garnered by the blogging associations was also notably high. It seems that while non-commercial participants were the most active in generating tweets on Twitter for the news event, it was the mainstream media, journalists, and commercial organizations that were more influential in terms of garnering retweets.

Next we analyze the levels of influence of the different participants when tweets related to the key political figures ("Putin", "Obama") were concerned (Figure 7 and Figure 8 below).
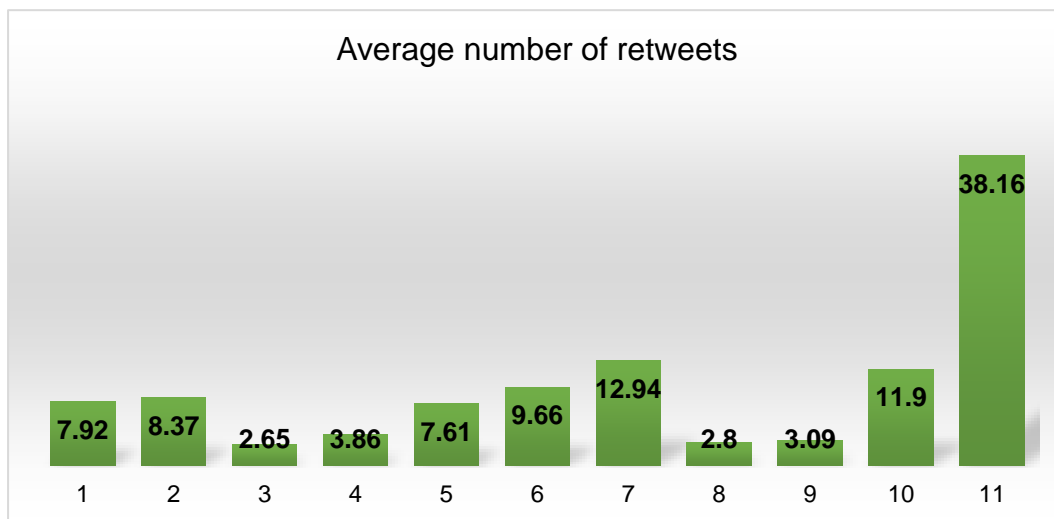
Fig. 7 Levels of Influence of the Different Participants in Tweets related to "Putin"

Legends: 1- Major news agencies; 2- Radio and TV stations; 3- Other news agencies; 4-News aggregator; 5- Journalists (affiliated); 6- Journalists (independent); 7- Blogging associations; 8- Independent bloggers; 9- Non-commercial participants; 10- Commercial organizations; 11- Celebrities
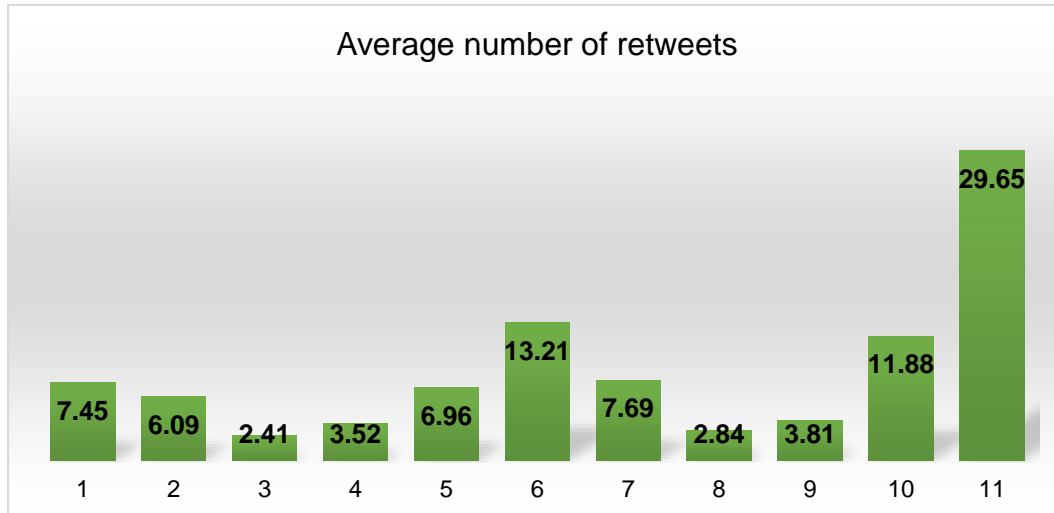
Average number of retweets

7.45	6.09	2.41	3.52	6.96	13.21	7.69	2.84	3.81	11.88	29.65
1	2	3	4	5	6	7	8	9	10	11

1

2 **Fig. 8** Levels of Influence of the Different Participants in Tweets related to "Obama"

3 It is, however, interesting to see that when people-related tweets are of focus (refer to
4 Figure 7 and Figure 8), the results present a very different picture. Mainstream media,
5 journalists, and commercial organizations no longer garnered the most retweets, but
6 celebrities emerged to be the one (and clearly many more than the other types of
7 participants). This unveils the content-dependent (event vs. people) influence of the
8 different participants in the news dissemination on Twitter. Another point worth noting
9 is that regardless of whether the event-related or people-related tweets were concerned,
10 the retweets garnered by the non-commercial participants remained low.

11

12 **4.3 Analysis of retweet distribution**

13

14 To gain further insights, we also examined the types of users/participants who retweeted
15 the tweets posted by the different users/participants. Figures 9-12 below show the
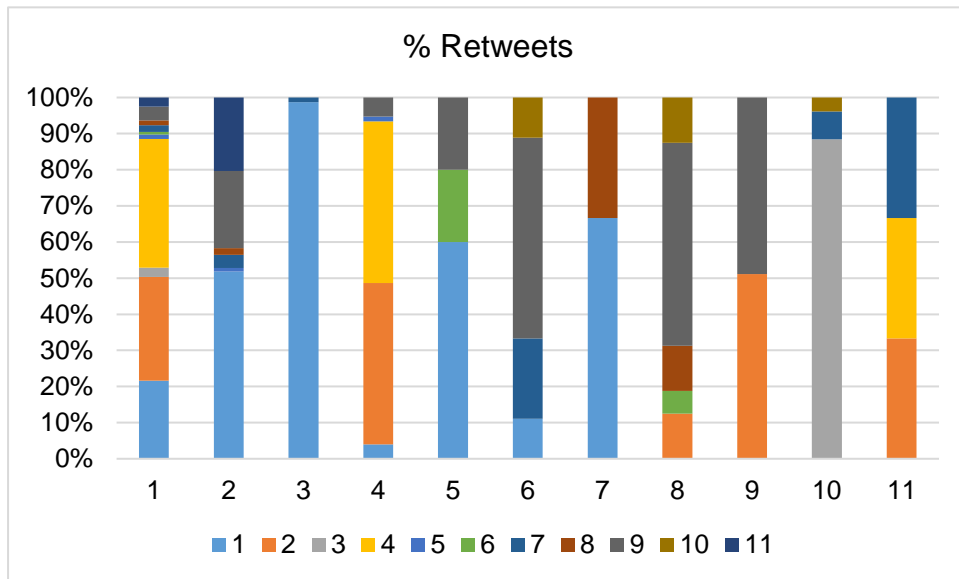16 analysis results.

17

% Retweets

Fig. 9 "Protest" and "Square" – Types of Users Who Retweeted in Each Category

Legends: 1- Major news agencies; 2- Radio and TV stations; 3- Other news agencies; 4-News aggregator; 5- Journalists (affiliated); 6- Journalists (independent); 7- Blogging associations; 8- Independent bloggers; 9- Non-commercial participants; 10- Commercial organizations; 11- Celebrities
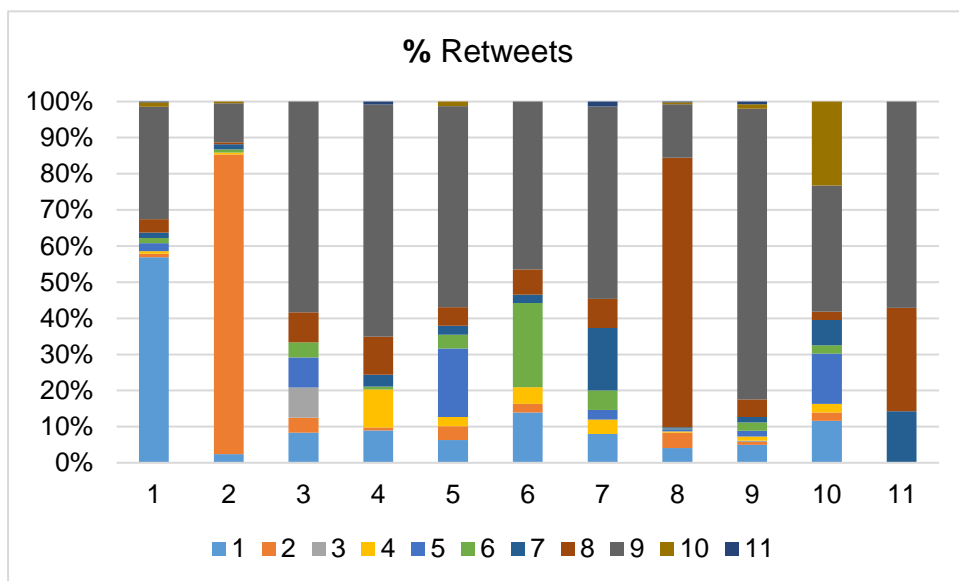

% Retweets

Fig. 10 "Russia" and "Troops" – Types of Users Who Retweeted in Each Category

Previously, it was found that five types of participants consistently attracted the most retweets in the keyword set "Protest" and "square", and the keyword set "Russia" and "troops", i.e., major news agencies, radio and TV stations, affiliated journalists, independent journalists, and commercial organizations. From Figures 9-10, more than half of the tweets regarding "Protest" and "square", and "Russia" and "troops" by

independent journalists were retweeted by non-commercial participants. Non-commercial participants were also the most active participant in retweeting the tweets about "Russia" and "troops" by affiliated journalists. However, they were secondary to major news agencies in retweeting the tweets regarding "Protest" and "square" by affiliated journalists. Nevertheless, these findings show the overall importance of non-commercial participants in retweeting the event-related tweets by individual journalists, again demonstrating their high involvement in the news dissemination.

As aforementioned, most of the tweets regarding "Protest" and "square" by affiliated journalists were retweeted by major news agencies. Major news agencies are also important participants in retweeting the tweets regarding "Protest" and "square" by other major news agencies (third place after news aggregator and radio and TV stations), radio and TV stations, and commercial organizations. Overall, these findings show the importance of major news agencies in retweeting the tweets regarding "Protest" and "square" by organization-based participants, depicting a "reinforcing" influence build-up among the "elite" participants.

Finally, while most of the tweets regarding "Russia" and "troops" by major news agencies were retweeted by other major news agencies, most of the tweets regarding "Russia" and "troops" by radio and TV stations were retweeted by other radio and TV stations, and most of the tweets regarding "Russia" and "troops" by commercial organizations were retweeted by non-commercial participants and other commercial organizations. These findings signal the importance of the same types organization-based participants in retweeting the tweets regarding "Russia" and "troops".
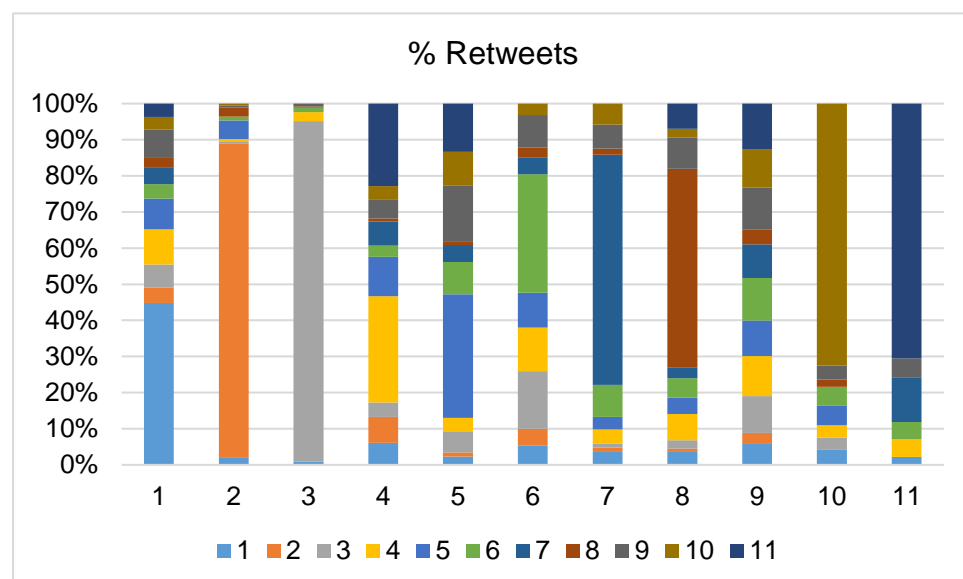

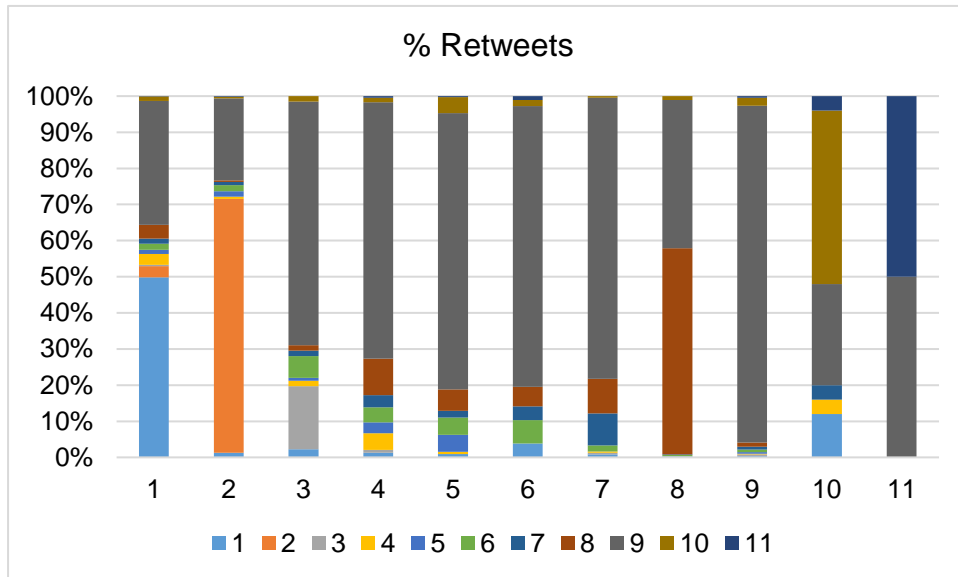**Fig. 11** "Putin" – Types of Users Who Retweeted in Each Category

1

2

3   **Fig. 12** "Obama" – Types of Users Who Retweeted in Each Category

4   It was also previously found that the participants who consistently attracted the most
5   retweets regarding the keywords "Putin" or "Obama" were the celebrities. From
6   Figures 11-12, we could see that while most the celebrities' tweets about Putin was
7   retweeted by the celebrities themselves, the celebrities' tweets about Obama was partly
8   retweeted by the celebrities themselves and partly retweeted by non-commercial
9   participants. Hence, while it is interesting to see the reinforcement effect of people-
10   related tweets by the celebrities, the involvements of non-commercial participants in
11   propagating the celebrities' people-related tweets remains notably salient.

12

13   **5. Discussion and Conclusion**

14

15   The open and interactive nature of social media has led to a belief that their use for
16   news dissemination may challenge the role of conventional news media (Hermida,
17   2010). This seems a reasonable expectation. However, our study highlights that whether
18   this holds depends on whether it is the "involvement" or the "influence" that is of
19   concern.

20

21   By analyzing tweet data during the Ukraine's conflict, our analyses unveil the following
22   insights: 1) indeed non-commercial participants (e.g., religious networks, charities,
23   volunteers) dominated the news tweeting landscape by being the most active and
24   posting the most tweets; 2) yet, the retweets they attracted, which is a commonly used

measure of influence (Cha et al., 2010), was among the lowest. In contrast, "elite" participants including journalists, professional associations and commercial organizations, while generated lesser tweets, took the crown in attracting retweets; 3) we further found an exception to this pattern - when the tweets focused on popular political figures (Obama, Putin) related to the event, celebrities' influence in terms of retweet count became salient.

As a whole, our findings suggest that the role of mainstream media remain dominant on Twitter. This is despite the fact that Twitter as a social media now enables a full spectrum of communications from personal and private to 'mass-personal' (e.g., celebrities) and traditional mass media (Walther et al., 2010). As this finding is less consistent with the common expectation that social media are dominated by ordinary non-commercial users (which should include the dissemination of news), below we try to offer explanations for why "elite" participants (major news agencies, radio and TV stations, affiliated journalists, independent journalists, and commercial organizations) are the ones who garnered greater retweets by building on the relevant literature.

5.1 Plausible reasons for the dominance of mainstream media in garnering retweets

Our further analysis shows that part of the retweets garnered by mainstream media can be explained by a reinforcing tendency of the "elite" participants in retweeting the tweets posted by their same kinds to some extents. However, we do see an active involvement of non-commercial participants in retweeting the posts of mainstream media, leading to the greater influence of the latter. That is, people seem to self-select news information from mainstream media to share with others (i.e., retweeting), causing the dominance of mainstream media in news dissemination to persist on Twitter. What may explain this tendency?

We believe an examination of people's motivations to retweet may offer some insights into this. We conducted a review of the literature that investigates motivations of retweeting (refer to Table A3 for a literature review). As can be seen from Table A3, there are various factors that may influence people's tendency to retweet a post. Among the literature, Boyd et al. (2010) is among the earliest studies that explore what may lead to people's retweeting behavior. Their exploratory study did not test the relative significance of the different factors identified, but noted, "[b]reaking news tends to be retweeted in the form of links to articles in media sources." (p.6) Subsequent studies have indicated similar factors, in addition to general factors such as information sharing, self-expression, and social interaction or social capital building (Abdullah et al. 2017; Lee et al. 2012; Park and Jeong 2011; Recuero et al. 2011). For instance, Abdullah et al. (2015) found that people retweeted a post because they believe the post is important,

an indication being that it is from official account or trusted sources. Lee et al. (2014) also found that people tended to retweet a post that contained a link to a significant report from a reputable media news source, as they believe such a post is more trustworthy. Indeed, credibility or trustworthiness of a news source is a common factor influencing retweeting that is identified in the literature (Abdullah et al. 2017; Boehmer and Tandor 2015; Metaxas et al. 2015).

From these studies, it can be seen that when news dissemination is concerned, news information from authoritative mainstream media may be perceived as more credible. Academic journals and trade press have indicated that the majority of news consumers still prefer mainstream news sources (83.8 per cent, see Fletcher and Park 2017), and that people's trust in social media as a news source is falling (Scott 2017). This may also have to do with the widespread occurrences of rumors on Twitter nowadays (Tanaka et al. 2012; Gupta et al. 2013; Mendoza et al. 2010; Vosoughi et al. 2018). Thus, users may he more careful to retweet information from other ordinary users (vis-à-vis information from mainstream media), especially if they do not possess first-hand understanding about a crisis event. Our findings with regard to the retweeting of information related to political figures may provide an opposite example that further supports this notion. We find that tweets by celebrities on political figures attracted the highest retweets. This may be due to the nature of such information that is more feeling- or perspective-based (e.g., whether a political figure makes a right or wrong decision), and so the credibility of news sources may matter less here.

Nonetheless, we should not ignore the observation that people's trust in mainstream media is decreasing as well (Fletcher and Park 2017). People may be concerned that news information reported on mainstream media are biased and not as objective as those shared by ordinary, non-commercial users. Still, people's motivations to retweet may provide an explanation of why people tend to retweet news information from mainstream media if this is the case. A recent research by Majmundar et al. (2018) highlights that people may retweet for the purpose of arguing against a tweet that they disagree with. Thus, when people see a news tweet that they feel is biased and disagree with, they may retweet it with their comments and views inserted. This expression of disagreement may also help the users achieve the purpose of building social interaction and social capital with other users (Lee et al. 2012; Park and Jeong 2011; Recuero et al. 2011), and they may find support of their views from mainstream media in other users.

Collectively, the preceding may explain why news information from mainstream c media tended to be retweeted more on Twitter.

5.2 Implications for research and practice

By affording the insights above, this research helps deepen our understanding of the nature and role of social media, in particular Twitter in news dissemination. First, we highlight the stark differences in the levels of involvement and influence among the various participants in news dissemination on Twitter. Second, by considering not only event-related tweets but also people-related tweets (popular political figures), we show the content-dependent influence of the different participants. Together these offer a more fine-grained and accurate understanding of the involvement and influence of the various participants on Twitter in news dissemination during conflicts such as the Ukraine episode.

In particular, the potential impact of Twitter in changing the established authority structures of news dissemination may be less than what is being expected. Although the state of involvements of the different participants is true to the conceived nature of social media (i.e., grassroots and non-commercial participants take the central stage), the elite participants such as mainstream media and journalists garnered the highest retweets and thus were the more influential in news dissemination.

To conventional media organizations, our results suggest that they should leverage Twitter for generating traffics to their websites by tweeting event-related snippets with links to specific news pages. As previously mentioned, such tweets from conventional media organizations garnered the highest retweets. This may be partly because they are perceived as validated news information, which are relatively safe to be retweeted. Due to the limited characters of a tweet, Twitter users may not be able to satisfy their curiosity of the news by simply reading the tweet. Instead, they will click on the accompanying links that will bring them to the news publisher's site. The widespread tweets are hence beneficial in bringing traffics to the websites of the conventional media organizations.

5.3 Limitations, future research directions, and conclusion

There are two limitations in this research that need to be recognized. First, we only focused on an important news event, i.e., Ukraine conflict. Future research may examine other events to assess the generalizability of our findings. Second, we only examined one area whereby the influence of the different types of participants could potentially vary, i.e., by considering tweets related to key political figures in contrast to those related to the event itself. Future research may try to identify other plausible areas wherein the levels of involvement and influence of the participants also differ.

Notwithstanding these limitations, our research contributes towards the extant research on the use of social media in news dissemination by providing a clearer understanding

1   on this issue. The user/participant types and the associated heuristic categorization rules
2   we developed may also be employed in relevant future research. We hope our research
3   can serve as a foundation for subsequent work in this area.

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13

Appendix – Supplementary Materials

15

Features	If any &str in "user_screen_name"→(in d1= 0 or 1)	If any &str in "user_description" "→ (ind2(3)= 0 or 1)	
Magazine		{"magazine"}	ind2
Newspaper		{"newspaper"}	
Othermedia	{'Mississauga','BBC','CNN','NYTimes','nytimes','LATimes','usatoday','AJE','sfchronicle','washingtonpost','AJAM','CBS','ABC','Bloomberg','Reuter','DailyMirror'}	{'@bbc',' cnn ', 'cnn.' 'cnn,', '@cnn','@latimes','@ajam','aljazeera', 'ny times', 'new york times','al jazeera','breaking news',\ 'huffington', 'washington post', 'wall street journal', 'york times', 'bloomberg','difficult stories', 'telegraph', 'usatoday', 'usa today','daily mirror','reuter'} **or** {'world news', 'news service', 'news network', 'news media', 'news agency', 'bringing latest news', 'latest news', 'source news', 'local news', 'covering latest', 'covering news', 'providing latest', 'provide latest', 'daily news', 'daily updates', 'leading source', 'leading provider', 'announce latest','announce news', 'stay connected', 'stay tuned', 'stay updated', 'stay informed', 'international news', 'global news', 'news provide', 'news features', 'news analysis', 'news feats'}	ind1*ind2
Tv_radio	{'Mississauga','BBC','CNN','NYTimes','nytimes','LATimes','usatoday','AJE','sfchronicle','washingtonpost','AJAM','CBS','ABC','Bloomberg','Reuter','DailyMirror'}	{'world news', 'news service', 'news network', 'news media', 'news agency', 'bringing latest news', 'latest news', 'source news', 'local news', 'covering latest', 'covering news', 'providing latest', 'provide latest', 'daily news', 'daily updates', 'leading source', 'leading provider', 'announce latest','announce news', 'stay	(ind1*ind2) or (ind2*ind3)

		connected', 'stay tuned', 'stay updated', 'stay informed', 'international news', 'global news', 'news provide', 'news features', 'news analysis', 'news feats'}}→ind2 {' tv ', 'radio', 'tv program','podcast','television program', 'tune in'}}→ind3	
Media_people		{'writer','anchor', 'host','editor', 'producer','correspondent',\ 'reporter','columnist','commentator','journalist','newsroom','photographer',\ 'presenter', 'curator', 'trustee', 'publisher', 'analyst', 'investigat', 'meteorologist',\ 'media specialist', 'media expert', 'illustrator','staff','writing'}	ind2
Affiliated		{"contributing", "contribute to","contributor","journalist for","journalist @","journalist at","journalist with","journalist of","associate","affiliate","staff","editor for", "affiliation","reporter at","reporter @","correspondent for","correspondent at","correspondent @","correspondent", "based",'present','i cover', 'head of', "writing in", "writing at", "write for","writing @", "writing for",'presenter of','work at'} AND NOT {"not affiliate","freelance", "unaffiliate", "non affiliate", "self employed", "self-employed"}	ind2
Independent		{ "independence", "independent", "autonomous", "autonom", "uncontrolled", "freelance", "free lance", "free-lance", "non profit", \ "nonprofit", "non-profit", "free"}	ind2
Blog	{ "mashable", "lifehack", "blog"}	{"blog", "trend", "blogger", "social media", "blogging", "enthusiast", "website", "vlog"}	ind1 or ind2
Fan_site		{"fan", "fanpage", "lover", "promoter", "fansite", "fan site", "fan page", "fanclub", "fan club", "fandom", "fanatic", "fanboy"}	ind2
Official_Site		{"official twitter account", "official account"}	ind2
Organized_effort		{"organization", "organisation", "foundation", "platform", "community", "fundrais", "campaign", "association", "venture", 'press release','.org'}	ind2
Former		{"former", "ex-", "retired", "departed", "prior", "latter"}	ind2
Aggregate	{"feed", "RSS", "Feed", "FEED"}	{"translat", "dispense", "repost", "re-post", "rssfeed", "rss feed", "rss-	ind1 or ind2

| | | feed", "rss", "review news", "review interviews", "sharing", "retweeter",\ "retweet endorsement", "news reader", "newsreader", "aggregat", "related news", 'news site', 'news website', 'news review', 'news insight', 'news gossip', 'news comment'} | |

Table A1 Features of the Participants

Class	Rule (for each user i)

1. Major News Agencies	if (features['magazine'][i]==1 and features['media_people'][i]==0 and \
	 features['tv_radio'][i]==0 and (features['blog'][i] == 0)
	 OR
	 if (features['magazine'][i]==1 and features['media_people'][i]==0 and \
	 features['tv_radio'][i]==0 and (features['blog'][i] == 0))
	 OR
	 if (features['othermedia'][i]==1 and features['media_people'][i]==0 and features['tv_radio'][i]==0 and (features['blog'][i] == 0)\
	 and if (features['independent'][i] == 0)and features['organized_effort'][i] == 0\
	 and features['fan_site'][i] == 0 and features['former'][i] == 0)

2. Radio and TV Stations	if (features['media_people'][i]==0 and features['tv_radio'][i]==1 and (features['blog'][i] == 0) and (features['independent'][i] == 0)and features['organized_effort'][i] == 0\ and features['fan_site'][i] == 0 and features['former'][i] == 0)
3. Other News Agencies	if ((features['magazine'][i] + \ features['newspaper'][i] + features['othermedia'][i] > 0) and features['media_people'][i]==0 and features['tv_radio'][i]==0 and (features['blog'][i] == 0) and (features['independent'][i] == 0)and features['organized_effort'][i] == 1\ and features['fan_site'][i] == 0 and features['former'][i] == 0)
4. News Aggregators	if (features['aggregate'][i]==1 and features['media_people'][i]==0 and features['tv_radio'][i]==0 and (features['blog'][i] == 0) and (features['independent'][i] == 0)and features['organized_effort'][i] == 1\ and features['former'][i] == 0)
5. Journalists Affiliated to News Agency	if (features['media_people'][i]==1 and (features['magazine'][i] + \ features['newspaper'][i] + features['othermedia'][i] > 0) and (features['affiliated'][i] == 1)\ and (features['independent'][i] == 0))
6. Independent Journalists	if (features['media_people'][i]==1 and (features['magazine'][i] + \ features['newspaper'][i] + features['othermedia'][i] > 0) and (features['affiliated'][i] == 0)\ and (features['independent'][i] == 1))
7. Blogging Associations	if ((features['blog'][i] == 1)\ and (features['independent'][i] == 0) and features['organized_effort'][i] == 1\ and features['former'][i] == 0)
8. Independent Bloggers	if ((features['blog'][i] == 1)\ and (features['independent'][i] == 1))
9. Others	Else

Table A2 Heuristic Rules to Categorize the Participants based on the Values of the Features

Author (year)	Context investigated	Research method	Findings about factors that influence retweeting
Boyd et al. (2010)	General	Secondary data analysis	- To amplify or spread tweets to new audiences - To entertain or inform a specific audience - To comment on someone's tweet - To make one's presence as a listener visible - To publicly agree with someone - To validate others' thoughts - As an act of friendship, loyalty, or homage by drawing attention, sometimes via a retweet request - To recognize less visible content - For self-gain, either to gain followers or reciprocity from more visible participants - To save tweets for future personal access
Suh et al. (2010)	General	Secondary data analysis	Characteristics of tweets that are more likely to be retweeted: - Tweets which contained URLs and hashtags - Tweets written by a user with a greater number of followers and followees, and a longer history of using Twitter
Park and Jeong (2011)	General	Survey	- More social interactions and more intimacy with people on their network, and for more influence on their followers - Information sharing (let other users know important information) - Responsiveness (be able to have immediate feedback) - Emotional propagation (share public indignation)
Recuero et al. (2011)	General	Survey	People retweet to build social capital
Lee et al. (2012)	General	Survey	- Information sharing - Social interaction building - Self-expression
Lee et al. (2014)	Health news (bird flu)	Secondary data analysis, experiment	Factors affecting retweeting (when requested): - Trustworthiness of the content to be spread (e.g., because it contained a link to a significant report from a reputable media news source) - Content relevance (e.g., because it happened in the retweeter's neighborhood) - Message contained valuable information and was helpful to society (e.g., the retweeter think the information is valuable)

Abdullah et al. (2015)	Disaster information	Survey	- Need to retweet (people believe it is important to spread the information, that the tweet is related to one's situation, and is from official account or trusted sources) - Interesting tweet content - Tweet user (e.g., which followers have retweeted)
Boehmer and Tandor (2015)	Sport news	Survey	- User characteristics: level of interest in a tweet topic, perceived relevance of the tweet, how similarity of the tweet information with personal opinion, and perception of how a tweet would affect followers - Content-related characteristics: tweet's style, informativeness, and originality - Source characteristics: perceived source credibility and likeability
Lee et al. (2015)	General	Survey	Altruistic motivation (other-oriented benefits) and reciprocity motivation (mutual exchange of favors) are related to behavioral intention of retweeting
Metaxas et al. (2015)	General	Survey	- Interest in a message - Trust in the message and the originator - Agreement with the message contents
Shen et al. (2015)	General	Modeling and experiment	Retweeting behavior is an outcome of the influence from the post (e.g., a post with rich information) and the influential users.
Abdullah et al. (2017)	Disaster information	Survey	- To provide relevant and updated information because the information is believable - Want people to know the information they perceive as important - The information capture retweeters' interest and they felt excited to share about the unusual situation - Want to get feedback and alert other people
Majmundar et al. (2018)	Health information	Survey	- To show approval (e.g., to show support to the tweeter) - To argue (e.g., to argue against a tweet that one disagrees with) - To gain attention, e.g., to increase followers - To entertain, e.g., humor/amusement

1   *Table A3 Factors Influencing People to Retweet (articles presented in chronological order)*

2